

What is claimed is:

1. A modified human prolactin molecule comprising the following amino acid sequence:

LPICPGGAAR CQVTLRDLFD RAVVLSHYIH NLSSEMFSEF **DKRYTHGRGF**
10 20 30 40 50

ITKAINSCHT SSLATPEDKE QAQQMNNQKDF LSLIVSILRS WNEPLYHLVT
60 70 80 90 100

EVRGMQEAPE AILSKAVEIE EQTKRLLEGM ELIVSQVHPE TKENEIYPVW
110 120 130 140 150

SGLPSLQMAD **EESRLSAYYN** LLHCLRRDSH KIDNYLKLLK CRIIHNNNC
160 170 180 190 199

wherein the prolactin molecule comprises at least one mutation in a region selected from i) amino acids 41-57, ii) amino acids 94-110, and iii) amino acids 160-173; and

wherein the at least one mutation is selected from deletions, replacements, and insertions.

2. The modified human prolactin molecule according to claim 1, wherein the prolactin molecule comprises at least one replacement mutation in region i), ii), and/or iii).
3. The modified human prolactin molecule according to claim 2, wherein at least one replacement mutation comprises replacing an amino acid having a nonpolar or hydrophobic side group, chosen from A, V, L, I, P, F, and M, with a polar acidic amino acid that is negatively charged at pH 6.0-7.0, chosen from D and E.

4. The modified human prolactin molecule according to claim 3, wherein at least one replacement mutation is chosen from F50E, I51E, A54E, I55E, L95E, L98E, V99E, V102E, L165E, L171E, and L172E.
5. The modified human prolactin molecule according to claim 2, wherein at least one replacement mutation comprises replacing an amino acid having an uncharged polar side group, chosen from G, S, T, Y, N, and Q, with a polar acidic amino acid that is negatively charged at pH 6.0-7.0, chosen from D and E.
6. The modified human prolactin molecule according to claim 5, wherein at least one replacement mutation is chosen from T45E, T52E, N56E, S57E, Y96E, Y168E, and Y169E.
7. The modified human prolactin molecule according to claim 2, wherein at least one replacement mutation comprises replacing a polar basic amino acid that is positively charged at pH 6.0-7.0, chosen from K, R, and H, with a polar acidic amino acid that is negatively charged at pH 6.0-7.0, chosen from D and E.
8. The modified human prolactin molecule according to claim 7, wherein at least one replacement mutation is chosen from H46E, R48E, K53E, H97E, and H173E.
9. The modified human prolactin molecule according to claim 2, wherein at least one replacement mutation comprises replacing an amino acid having an uncharged polar side group, chosen from G, S, T, Y, N, and Q, with an amino acid having a nonpolar or hydrophobic side group, chosen from A, V, L, I, P, F, and M.

10. The modified human prolactin molecule according to claim 9, wherein at least one mutation is G49F.
11. The modified human prolactin molecule according to claim 2, wherein at least one replacement mutation comprises replacing a polar basic amino acid that is positively charged at pH 6.0-7.0, chosen from K, R, and H, with an amino acid having a polar or hydrophobic side group, chosen from A, V, L, I, P, F, and M.
12. The modified human prolactin molecule according to claim 9, wherein at least one mutation is chosen from H46A, R48A, and H47F.
13. The modified human prolactin molecule according to claim 1, wherein the prolactin molecule comprises at least one deletion mutation in region i), ii), and/or iii).
14. The modified human prolactin molecule according to claim 13, wherein at least one deletion mutation comprises a single deletion of an amino acid chosen from amino acids 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, and 173.
15. The modified human prolactin molecule according to claim 14, wherein at least one deletion mutation comprises a deletion of F50.
16. The modified human prolactin molecule according to claim 13, wherein at least one deletion mutation comprises deletion of more than one amino acid chosen from amino acids 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108,

109, 110, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, and 173.

17. The modified human prolactin molecule according to claim 16, wherein at least one deletion mutation comprises a deletion of amino acids chosen from 41-57, 94-110, 160-173, 41-49, 50-57, 41-42, 41-43, 41-44, 41-45, 41-46, 41-47, 41-48, 41-50, 41-51, 41-53, 41-54, 41-55, and 41-56.

18. The modified human prolactin molecule according to claim 1, wherein the prolactin molecule comprises at least one insertion mutation in region i), ii), and/or iii).

19. A modified human prolactin molecule that exhibits the following characteristics:

- 1) exhibits antagonist activity;
- 2) binds to prolactin receptor through site 1;
- 3) does not bind to prolactin receptor through site 2 or has greatly diminished binding through site 2; and
- 4) exhibits less than 1% of unmodified prolactin's agonist activity.

20. The modified human prolactin molecule according to claim 19, wherein the prolactin molecule exhibits less than 0.9% of unmodified prolactin's agonist activity.

21. The modified human prolactin molecule according to claim 20, wherein the prolactin molecule exhibits less than 0.5% of unmodified prolactin's agonist activity.

22. A pharmaceutical composition comprising the modified human prolactin molecule according to claim 1 and at least one pharmaceutically acceptable excipient.
23. A method of treating a cancer comprising administering an effective therapeutic amount of the modified human prolactin molecule according to claim 1.
24. The method according to claim 23, wherein the cancer is breast cancer or leukemia.
25. The modified human prolactin molecule according to claim 1, with the proviso that the deletion is not of amino acids 41-52.
26. A method for reducing or suppressing lactation comprising administering an effective therapeutic amount of the modified human prolactin molecule according to claim 1.